

[Claims]

[Claim 1] A ** of composition which is shown by Formula (1) M1aM2 and Sbs 0.25≤a≤2, and formula (2) M3 -- [It is shown by M2' and] Are B ** of composition which fits 1≤b and a≤1, the active material anode has, and [M1 and M1'] Na, K, Rb, Cs, Os, Y, Zr, Hf, V, Nb, Ta, Co, Sr, Ba, Y, La, Ce, Mo, W, Mn, Fe, Ru, Are at least one sort of elements chosen from the group which consists of Os, Co, Rh, Ir, nickel, Pd, Cu, Ag, and Fe (m1), and [M2 and M2'] The *** active material for nonaqueous electrolyte rechargeable batteries characterized by being at least one sort of elements chosen from the group which consists of aluminum, Ga, In, Bi, germanium, Sn, Pb, Sb, and Bi (m2)

[Claim 2] The *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 which consists of 0 to 50 weight % of ** other than 20 to 80 weight % of A ** 20 to 80 weight % of B **, A **, and B **.

[Claim 3] The *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 or 2 which 50weight % or more of A ** is distributing in the matrix of B ** where B ** is activated.

[Claim 4] The *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 to 3 which one of ** of A ** and B ** are distributing to island shape with an average particle diameter of 0.05-20 micrometers in the matrix of ** of another side, or both A ** and B ** become from a particle with an average particle diameter of 1-20 micrometers, respectively.

[Claim 5] The *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 to 4 in which A ** and B ** have the lamellar structure which becomes in phase mutually.

[Claim 6] The *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 to 5 whose average cross-section area of the crystal grain of A ** and B ** observed in arbitrary sections is ten or less ten to 7 cm.

[Claim 7] The *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 whose average particle diameter of an active material is 45 micrometers or less.

[Claim 8] The manufacturing process of the *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 to 7 characterized by compounding by the plasma method, the atomizing method, the rapid cooling method, the cooling process, the mechanical alloy method, or the mechanochemical method.

[Claim 9] The single substance of various materials elements is melted by mass and refined (refined or granulated, and arbitrary) The process cast in an air melting furnace, and the obtained casting is cooled under argon atmosphere. The manufacturing process of the *** active material for nonaqueous electrolyte rechargeable batteries according to claim 1 to 7 characterized by mixing the process made into spherical particles by the gas atomizing method by diameter of injection nozzle 0.5-5mmφ, the injection pressure 80 - 300 kg/cm².

MnSiS₂, MnSiS₃. It is desirable that they are at least one sort of ⁺ chosen from the group which consists of FeSiS₂, FeSiS₃, CoSiS₂, CuSiS₂, NiSiS₂, NiSiS₃, CuSiS₃, CuSiS₄, and Cu₂SiS₃ [0018] Moreover, they are at least one sort of ⁺ chosen from the group which a ⁺ comprises from TiSiS₂, MnSiS₂, VSiS₂, MnSiS₃, FeSiS₃, and CuSiS₃ in rare active material. It is desirable that B ⁺ are at least one sort of ⁺ chosen from the group which consists of MgSiS₂, CaSiS₂, CaSiS₃, VSiS₃, TiSiS₃, CrSiS₂, MoSiS₂, MnSiS₂, FeSiS₂, CoSiS₂, CuSiS₂, NiSiS₂, and Cu₂SiS₂.

[0017] A ⁺ in said active material Moreover, MgSiS₂, CoSiS₂, SiS₂. They are at least one sort of ⁺ chosen from the group which consists of CoSiS₂, CrSiS₂, CoSiS₃, MnSiS₃, and CuSiS₃. It is desirable that B ⁺ are at least one sort of ⁺ chosen from the group which consists of VSiS₂, MnSiS₂, MnSiS₃, FeSiS₂, CoSiS₂, and CuSiS₂.

[0016] Moreover, in said active material [A ⁺] Cu₂Al₂, Cu₂Al₂, SnAl₂, BaAl₂, BaAl₂, LaAl₂, LaAl₂, CoAl₂, CoAl₂, TiAl₂, ZrAl₂, ZrAl₂, VAl₂, VAl₂, Al₂Al₂, TiAl₂, YAl₂, CrAl₂, MnAl₂, VAl₂, MnAl₂. They are at least one sort of ⁺ chosen from the group which consists of lanthanum Cobaltaluminum, CuAl₂, FeAl₂, FeAl₂, NiAl₂ and hexavalent aluminum, B ⁺ SnAl, BaAl, LaAl, La₂Sn₂ Samarium, CoAl, It is desirable that they are at least one sort of ⁺ chosen from the group which consists of Cobaltaluminum, TiAl, ZrAl, ZrAl₂aluminum, Manganese, MnAl, FeAl, Fealuminum, CoAl, NiAl, CoAl and Cobaltaluminum.

[0015] A ⁺ in said active material Moreover, SnAl, BaAl, LaAl. They are at least one sort of ⁺ chosen from the group which consists of CoAl, TiAl, ZrAl, MnAl, FeAl, CuAl, NiAl, and Cu₂Al. It is desirable that B ⁺ are at least one sort of ⁺ chosen from the group which consists of Laaluminum, Coaluminum, ZrAluminum, Manganese, Fealuminum and Cualuminum.

[0014] Moreover, the invention relates to the manufacturing process of said active material characterized by compounding by the plasma method, the sintering method, the rapid casting method, the casting process, the mechanical alloy method, or the mechanical method. Moreover, the invention relates to the simple substance of various material elements by mass, and ratios tabular or granular, and arbitrary. It is related with the manufacturing process of said active material characterized by having the process part in an air melting furnace, and the process which makes spherical particles the obtained casting whole by the gas sintering method under argon atmosphere by diameter of spherule nuclei 0.5-5mm, the sintering pressure 50 - 100 kPa/cm². Furthermore, the invention relates to the non-aqueous electrolyte rechargeable battery possessing the plus terminal in which charge and discharge are possible, non-aqueous electrolyte and ⁺ which consists of said active material. In addition, in this invention, an active material means the material when contains an active portion electrochemically, and the material covering an internal portion is also included in an active material.

[0021]

Make for spreading out the invention; the active material of the invention is shown by formula (1) $M_1AM_2 \rightarrow O$ (2) $A \rightarrow A^{++}$, A^{++} of composition which has 0 to 100 weight % of A^{++} and formula (2) $B^{++} \rightarrow B$ is shown by BAM_2 and has 1 to 95 and 4 to 95, and B^{++} of composition that has 1 to 95 and 4 to 95, preferably, the case where an active material has A^{++} and B^{++} -- an active material -- fine -- powdering is conducted and degradation of the battery by a charge-and-discharge cycle is suppressed, since the difference of the expansion stress of the fine of the lithium compound of A^{++} and that of B^{++} is small, fine is considered because the expansion stress in the whole active material is exerted uniformly. Among a formula (1), if the expansion stress of A^{++} is very large when it is smaller than 0.25, and it becomes easy to powder fine and it becomes three or more, a unit weight and the amount of Li reactions per volume will become small too much, and will turn into low capacity. Moreover, if the expansion stress of B^{++} will also become large, loss of will expand among a formula (2), if it becomes less than one, and it is increased, the stress difference of A^{++} and B^{++} will become intense. Moreover, relief of the expansion stress by making two or more A^{++} which carry out oxidation of the lithium exist. As for a and b, from balance with equalization of the expansion stress in the whole active material by making small the difference of the expansion stress of A^{++} , and that of B^{++} etc., it is desirable to be 1 to 10 (a) < 17 and also 1.5 to 10 (a) < 5.

[0022] M_1 and M_2 among a formula (1) and a formula (2) may be at least one sort of elements chosen from the group which consists of Na, V, Pb, Cs, Co, Ti, Zr, Hf, V, Hf, Ta, Ca, Sr and Ba, Y, La, Ce, Nd, W, Mo, Te, Bi, Os, Cu, Ru, Ir, Nickel, Pd, Au, Ag, and Fe (m1). Although two or more elements may be contained, as for A^{++} of 1, it is desirable to consist of an element chosen from one sort of groups (M1). When A^{++} and B^{++} consist of an element chosen from one sort of groups (m1) respectively, it is desirable also in a group (m1) to consist of Ti, Zr, Sr, Ba, Mo, Co, Nickel, and Cu or Fe, and it is especially desirable to consist of Ti, Mn, Cu, Co, or Fe.

[0023] M_2 and M_1 are at least one sort of elements chosen from the group which consists of aluminum, Ga, In, Ge, germanium, Sn, Pb, Bi, and Sb (m2) among a formula (1) and a formula (2). Although two or more elements may be contained, as for B^{++} of 1, it is desirable to consist of an element chosen from one sort of groups (m2). When A^{++} and B^{++} consist of an element chosen from one sort of groups (m2) respectively, it is desirable also in a group (m2) to consist of aluminum, In, Ge, germanium, and Sn or Pb, and consisting of aluminum, Si, or Li is especially desirable.

[0024] As for the active material which has A^{++} and B^{++} , it is desirable to consist of 0 to 50 weight % of A^{++} other than 20 to 30 weight % of B^{++} , further 40 to 70 weight % A^{++} and 8 to 10 and further 5 to 30 weight % 20 to 30 weight % of A^{++} and further 30 to 60 weight % B^{++} . Moreover, it is desirable to have the interface which A^{++} and B^{++} contacted. The contact interface of A^{++}

sort of elements chosen from the aforementioned (m1) group here, and M2' is at least one sort of elements chosen from the aforementioned (m2) group. Moreover, one or more sorts of "" which consist any of an element chosen from the group, for example (m1) may exist. In this case, although electric discharge capacity decreases slightly, it becomes possible (1) obtaining full finger landing active material packing. Moreover, although "" which consists one of an element chosen from the group (m2) may also exist, it is desirable that it is 10 or less weight % on the characteristic of a battery and in all the above materials.

[0021] A "" in said active material independent or when (1) of Na2O, K2O, SrO, BaO, La2O3, Ce2O3, ZrO2, Mn2O3, Co2O3, PbO2, or Fe2O3; it is two or more sorts. B "" Na2SO4, K2O, Cu2O, ZnSO4, ZnS, V2O5, Nb2O5, Ta2O5, MoS2, Mn2O3, Mn2S3, it is desirable independent or that they are two or more sorts of FeS, Fe2S3, Fe3O4, Cu2O, Cu2S, Cu2Se, Cu2Te, Cu2Sb, Cu2Bi, Cu2In, TiS2, or Ti2S3.

[0022] Moreover, that Na2O, K2O, FeS, Co2O3, or PbO2 is independent or when it is two or more sorts, A "" is said active material; B "" Na2SO4, Cu2O, ZnSO4, ZnS, V2O5, Nb2O5, it is desirable independent or that they are two or more sorts of Ta2O5, Mn2O3, Mn2S3, Fe2S3, Fe2Se, Fe2Te, Cu2Sb, Cu2Bi, Cu2In, TiS2, or Ti2S3.

[0023] Moreover, independent or when (1) of Fe2O3 or Co2O3; it is two sorts, A "" in said active material; B "" Na2SO4, La2SO4, ZnSO4, ZnS, V2O5, Nb2O5, it is desirable independent or that they are two or more sorts of Ta2O5, Mn2O3, Mn2S3, Ti2O3, Cu2O, Fe2O3, Fe2S3, Fe2Se, Cu2Sb, Cu2Bi, Cu2In, TiS2, or Ti2S3.

[0024] A "" in said active material. Moreover, Na2SO4, K2SO4, Mg2SO4, that Cu2O, SrO, Ba2SO4, La2SO4, or Ti2SO4 is independent or when it is two or more sorts, B "" it is desirable independent or that they are two or more sorts of Mn2SO4, Fe2SO4, Fe2S4, Cu2SO4, Cu2Se, Cu2Te, Cu2Sb, Cu2Bi, Cu2In, or Ti2SO4.

[0025] Moreover, in said active material; A "" Na2O2, Cu2O2, SrSO4, BaSO4, V2O5, La2O3, Co2O3, TiO2, ZrO2, V2O2, Nb2O2, Ta2O2, Cu2O2, Mn2O2, W2O2, Mo2O2, Co2O2, Cu2O2, Fe2O2 or independent or when (1) of Nb2O2; it is two or more sorts, B "" Na2O, K2O, Mg2O, Cu2O, Cu2S, FeS, Fe2S3, ZnS, V2O5, Nb2O5, Ta2O5, Co2O3, Cu2O, Cu2S, Cu2Se, Cu2Te, Cu2Sb, Cu2Bi, Cu2In, TiS2, or Ti2S3. It is desirable independent or that they are two or more sorts of FeS, Fe2O3, Fe2S3, Co2O3, Cu2O, Cu2S, Cu2Se, Cu2Te, Cu2Sb, Cu2Bi, Cu2In, or Cu2O.

[0026] A "" is said active material. Moreover, Na2O, K2O, Cu2O, that Cu2S, TiS2, ZnS, Cu2O, Mn2O, Fe2O, Cu2O, PbO, NiS, or Cu2O is independent or when it is two or more sorts, B "" Mg2O, Cu2O, Cu2S, Cu2Se, Cu2Te, Cu2Sb, Cu2Bi, Cu2In, TiS2, or Ti2S3. It is desirable independent or that they are two or more sorts of Cu2O, Mn2O, W2O, Mn2O, Mn2S, Fe2O, Fe2S, Cu2O, Cu2Se, Cu2Te, Cu2Sb, Cu2Bi, Cu2In, or Cu2O.

[0027] Moreover, independent or when (1) of TiS2, Na2O, V2O5, Mn2O3, Fe2O3, or Cu2O; it is two or more sorts, A "" is said active material; B "" it is desirable independent or

or that they are two or more sorts of Mg2Si, Ca2Si, CaSi, AlSi, FeSi, Cr2Si, Mo2Si, Nb2Si, Fe3Si, Co2Si, CuSi, NiSi2, NiSi, Cu3Si or Cu4Si.

[0034] A *** in said active material Moreover, Mg2Si, Cu2Si, Si3, That Cu2Si, CuSi, Cu2Si, CuSi, or CuSi is independent or when it is two or more sorts, as for B **, it is desirable independent or that they are two or more sorts of V2Si, Mo2Si, MoSi, FeSi, Cu3Si, Cu3Si, or Cu4Si.

[0035] Moreover, in said active material [A **] CoSi, CoSi2, NiAl, NiAl2, NiAl, LaAl, LaAl2, CoAl, CoAl2, TiAl, ZrAl, ZrAl2, VAl, Vanadium, MoAl, FeAl, CrAl, MoAl, VAl, NiAl, independent or when [of NiAl3, Cr2aluminum2, CuAl2, FeAl3, FeAl2, FeAl3 or Nickelaluminum3] it is two or more sorts, it has desirable B ** independent or that they are two or more sorts of BrAl, BrAl, LaAl, La2aluminum2, CrAl, Chromium2, TiAl, ZrAl, Zr2aluminum, Mo2aluminum, NiAl, FeAl, Fe2aluminum, CoAl, NiAl, CuAl or Cr2aluminum3. [0036] A ** in said active material Moreover, SiAl, BaAl, LaAl, Then CoAl, TiAl, ZrAl, BaAl, FeAl, CuAl, ZrAl, or CuAl is independent or when it is two or more sorts, as for B **, it is desirable independent or that they are two or more sorts of La2aluminum2, Cr2aluminum2, Zr2aluminum, Mo2aluminum, Fe2aluminum, or Cu2aluminum3.

[0037] The active material concerning the invention can be the simple substance of various material elements by mass and shape tabular or granular, and arbitrary, for example, and can compound it by being independent, or combining the method, for example, the plasma method, or performing preformed heat treatment, the sintering method, a rapid cooling method, or a casting process, and using it. Moreover, otherwise, it is compoundable by the mechanical alloy method and the mechanochemical method. According to said plasma method, very small particles are easy to be obtained, according to said sintering method, very small spherical particles are easy to be obtained, and mass production nature is good. According to said rapid cooling method, the particles of a very small organization are easy to be obtained, and according to said casting process, composition is easy. According to said mechanical alloy method or said mechanochemical method, very small particles and a detailed organization can be realized. As a manufacturing process of said more desirable active material, for example [the simple substance of various material elements] The manufacturing process which consists of a process which mixes by mass and shape tabular or granular, and arbitrary, and is cast in an iron melting furnace, and a process which makes spherical particles, the obtained casting article by the gas sintering method under argon atmosphere by diameter of injection needle 0.5-5mm, the injection pressure 10-300 kg/cm², a temperature

[0038] The non-aqueous electrolyte rechargeable battery of the invention can be obtained, if *** is produced by a general method using said active material and it combines with the plus terminal and nonaqueous electrolyte in which charge and discharge are possible.

[0039]

[Working example] Next, although this specimen is explained and more concretely defined on a work example, there do not limit the invention.

<Work example 1-05> ** which covers only of an element which has the active material composition (composition of a material element shown in Tables 1-3, and was chosen from A **, B **, and a group (m2)) (at over Table 1-3, it is indicated as C **) in addition, it set in the sequence of (1) ** and the numerical value in () shows weight % of C ** in an active material, the same in Table 4, and other ** (the display ** in the sequence of other ** does not mean the other ** do not exist among Table 1-3.) the same as Table 4, from a each bounding active material was prepared in the following procedures. It mixed by mass and ratio inhibitor or granular, and granular, and the single substance of various materials elements was cast in the hot melting furnace. The obtained casting article was made into spherical particles under argon atmosphere using the gas atomizing method. At this time, the diameter of an injection nozzle was 1mm, and injection pressure was 100kgf/cm². Through and an active material particle with an average particle diameter of 20 micrometers were obtained for the sieve of the 45-micron mesh in the obtained particles.

[0040] When analyzes the obtained active material particles according to an X diffracton, consists of two or more ** shown in Table 5, and consists of 20 to 65 weight % of A **, 40 to 70 weight % of B **, 0 to 10 weight % of ** (C **) that covers only of an element chosen from the group (m2), and 0 to 20 weight % of other ** was mixed. When surface analysis by EDS/EDX was conducted in the selected active material particles, the average particle consists of the crystal grain of every active materials particle was within the range of 0.3–1.3 micrometers. Moreover, the average cross-section area of the crystal grain wasn't constitutes A **, and B ** was 5x10⁻¹⁴m² at the maximum.

[0041]

[Table 7]

序號	名稱	單位	數量	單位	價格	金額	備註
10	鋼筋	鋼筋	1000	kg	2.50	2500	
11	鋼筋	鋼筋	1000	kg	2.50	2500	
12	鋼筋	鋼筋	1000	kg	2.50	2500	
13	鋼筋	鋼筋	1000	kg	2.50	2500	
14	鋼筋	鋼筋	1000	kg	2.50	2500	
15	鋼筋	鋼筋	1000	kg	2.50	2500	
16	鋼筋	鋼筋	1000	kg	2.50	2500	
17	鋼筋	鋼筋	1000	kg	2.50	2500	
18	鋼筋	鋼筋	1000	kg	2.50	2500	
19	鋼筋	鋼筋	1000	kg	2.50	2500	
20	鋼筋	鋼筋	1000	kg	2.50	2500	
21	鋼筋	鋼筋	1000	kg	2.50	2500	
22	鋼筋	鋼筋	1000	kg	2.50	2500	
23	鋼筋	鋼筋	1000	kg	2.50	2500	
24	鋼筋	鋼筋	1000	kg	2.50	2500	
25	鋼筋	鋼筋	1000	kg	2.50	2500	
26	鋼筋	鋼筋	1000	kg	2.50	2500	
27	鋼筋	鋼筋	1000	kg	2.50	2500	
28	鋼筋	鋼筋	1000	kg	2.50	2500	
29	鋼筋	鋼筋	1000	kg	2.50	2500	
30	鋼筋	鋼筋	1000	kg	2.50	2500	
31	鋼筋	鋼筋	1000	kg	2.50	2500	
32	鋼筋	鋼筋	1000	kg	2.50	2500	
33	鋼筋	鋼筋	1000	kg	2.50	2500	
34	鋼筋	鋼筋	1000	kg	2.50	2500	
35	鋼筋	鋼筋	1000	kg	2.50	2500	
36	鋼筋	鋼筋	1000	kg	2.50	2500	
37	鋼筋	鋼筋	1000	kg	2.50	2500	
38	鋼筋	鋼筋	1000	kg	2.50	2500	
39	鋼筋	鋼筋	1000	kg	2.50	2500	
40	鋼筋	鋼筋	1000	kg	2.50	2500	
41	鋼筋	鋼筋	1000	kg	2.50	2500	
42	鋼筋	鋼筋	1000	kg	2.50	2500	
43	鋼筋	鋼筋	1000	kg	2.50	2500	
44	鋼筋	鋼筋	1000	kg	2.50	2500	
45	鋼筋	鋼筋	1000	kg	2.50	2500	
46	鋼筋	鋼筋	1000	kg	2.50	2500	
47	鋼筋	鋼筋	1000	kg	2.50	2500	
48	鋼筋	鋼筋	1000	kg	2.50	2500	
49	鋼筋	鋼筋	1000	kg	2.50	2500	
50	鋼筋	鋼筋	1000	kg	2.50	2500	

2061

Page 28

opposite poles by 0.5mA constant current about the examination cell (when testing an active material electrode as $^{+}$). It is equivalent to charge. Anodic polarization was carried out and the electrode was set to 1.1V next (when testing an active material electrode as $^{+}$). It is equivalent to electric discharge. Then, cathodic polarization and anodic polarization were repeated. The first time a certain discharge capacity per 1g of active material in this time is shown in Tables 1-3. Next, the examination cell was decomposed, and when the discharge 1 after 10 cycle $^{+}$ was taken out and after cathode polarization and anode polarization and anode polarization were observed, the degree (DENUO light) of metal lithium in an electrode surface was not seen.

[0747] Next, in order to evaluate the cycle characteristics of a battery of having used said active material for $^{+}$, the cylindrical battery shown in drawing 2 was produced. LHM1 80A7.2C34 which are a pure terminal active material mixed Li2O3, Ni3O4, and Cu2O2 by the predetermined molar ratio, and may compounded them by heating at 900 degrees C. Furthermore, what carried out the part glass of this in 100 or less moisture also made into the plus terminal active material. To 100g of pure terminal active materials, water CH3PPA/PDM of Pentaerythritol tetraacetate was added to carbon powder as an electric conduction agent. 8g and pure water were added by the rule-of-mix principle as 10g and a binder, and it was made the shape of a paste, and if applied to the core material of titanium it dried and pressed, and the plus terminal board 11 was obtained.

[0748] Next, it mixed with solid each active material by the bulk density as an electric conduction agent, the fluorocarbon (Teflon) binder was mixed with graphite powder at a ratio of 25:20:10 as a binder, and it was made the shape of a paste using the oil system solvent applied to the support core material, and dried at 100 degrees C, and the negative polar plate 12 was obtained.

[0749] The bond-like separator 13 whose width is wider than a two-poles board was made to connect between the pure material attached by spot welding, the plus terminal board 14 which has the plus terminal lead 14 of the quality of the material, the core material attached by spot welding, and the negative polar plate 12 which has the $^{+}$ lead 15 of the quality of the material, and the whole was spirally wound around it. The -o electric insulating plate 16 and the lower electric insulating plate 17 made from polypropylene were arranged on each upper and lower sides in the winding filling, and it inserted in $^{+}$ 18. After making a step from in the upper part of $^{+}$ 18, as nonaqueous electrolyte, the mixed solution of 1.4 was filled in by the volume ratio of ethylene carbonate and dimethoxyethane which depressed potential, and because that it might become in 1 and 1mol/L, and it sealed after the observation found by and the battery was completed. Porous polypropylene was used for the separator 13. In addition, 20 shows a plus terminal terminal among drawing 2.

[0750] About the observed voltage, charge and discharge current maximum were performed

with the heat temperature of 80 degrees C, and the charge-discharge cycle orientation was done in the charge-and-discharge-voltage range of 4 V-2.8V. The capacity maintenance rate of the 100 cycle cycle to 1 cycle cycle is shown in Table 4-3.

[0030] <Comparative examples 1-7> The particles of 5m copper sulfide shown in Table 4, and aluminum simple substance (average particle diameter of 25 micrometers), The particles which consist only of Cu₂Sn²⁺, the particles which consist only of FeAl²⁺ (1st: average particle diameter of 25 micrometers) (The particles which consist of the average particle diameter of 2.1 micrometers, and Mg/permanium²⁺ and Mg element phase of a crystal grain (1 average particle diameter of 25 micrometers) (The average particle diameter of 3.2 micrometers of a crystal grain and Mg/permanium, fig 7.1) (minor ratio). The particles which consist of Mg₂Sn²⁺ and a Mg element phase (1 the average particle diameter of 2.7 micrometers), and average particle diameter of 3.3 micrometers of a crystal grain) (Mg₂Sn₂Al₂/ case 1) (where the particles (the average particle diameter of 2.7 micrometers, the average particle diameter of 3.3 micrometers of a crystal grain, and Mg₂Sn₂Sn₂ are 7:3 (minor ratio) which consist of 6:2 (minor ratio Mg₂Sn²⁺ and Sn²⁺ are used) (asked for the first time electric discharge capacity of an examination used, and the capacity maintenance rate of the 100 cycle cycle to 1 cycle cycle of a cylindrical battery like the case of a work example. These results are shown in Table 4

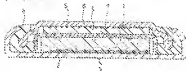
[0030]

[Table 4]

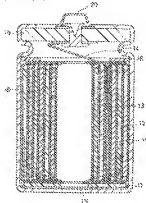
比較例	添加物 種類	成分	割合	容量	容量 維持率	容量低下率 (%)	容量低下率 (%)
1	Sn	-	-	8000	-	40	10
2	Al	-	-	1000	-	100	5
3	Mg ₂ Sn	Cu ₂ Sn ²⁺	-	-	-	100	10
4	FeAl	FeAl ²⁺	-	-	-	100	10
5	Mg ₂ Sn/Mg	Mg ₂ Sn	-	-	84	100	10
6	Mg ₂ Sn/Mg	Mg ₂ Sn	-	-	100	100	10
7	Mg ₂ Sn/Sn	Mg ₂ Sn	-	1000	-	100	10

[0030] In the battery which used the above material composition, the reaction for "1" is high capacity compared with a comparative example, and Tables 1-4 show that the cycle characteristic is markedly able and good ones. In addition, in said work example, although the cylindrical battery was produced, it is thinking that the same effect is required also in a coin type, a square shape, and in the rechargeable battery. Moreover, in said work example, although the gas identifying method was adopted, even if a adaptive and passive method is rapid

[Drawing 1]



[Drawing 2]



[Translation done]